

1 37398/SAH/C715

ENCAPSULATED OPTOELECTRONIC DEVICES WITH CONTROLLED PROPERTIES

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Abstract of the Disclosures

An optoelectronic device, such as a VCSEL, is disclosed whose transmission does not change upon encapsulation by a material such as plastic, epoxy or other suitable encapsulant with a known index of refraction. The surface reflection of the VCSEL surface is very different depending on whether it is terminated in air or the encapsulant, with a much larger reflection in the case of air. It is known that the surface reflection can be made out of phase with the rest of the mirror, effectively increasing the transmission. The amount of the transmission increase can be adjusted by controlling the thickness of the surface layer. Once the VCSEL is encapsulated, the surface reflection is reduced, and the transmission at the facet is increased but the dephased reflection is also reduced. Depositing a surface layer whose index of refraction is similar to the encapsulant, and adjusting the surface layer thickness correctly, the overall transmission from the laser into the terminating material is unchanged, be it air or encapsulation. As a result, the laser properties such as slope efficiency and threshold current are unchanged upon encapsulation. The same procedure may be applied to devices other than VCSELs such as other types of lasers, LEDs, and resonant cavity photodetectors to achieve encapsulated optoelectronic components with controlled properties that remain unchanged upon encapsulation.

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DLM PAS240484.1-

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